INFORMATION

Medical Aspects of Parathion Insecticide

The group of insecticides known as organic phosphates has come into widespread use in the past few years, and because of their efficiency as economic poisons will undoubtedly be encountered more frequently. A previous bulletin described the pharmacology and toxicology of hexaethyl tetraphosphate and tetraethyl pyrophosphate, two compounds of this group. The present article is concerned with a third member, parathion (O, O-diethyl-O-P-nitrophenyl-thiophosphate) which is equally toxic and potentially hazardous if improperly handled.

During the past year (1948-1949) the Bureau of Adult Health has received reports of seven cases of parathion poisoning occurring in California. Undoubtedly there have been others which were not reported. Three parathion deaths and one near fatality have recently been reported in the East. Since parathion (also commercially known as Thiophos) has only recently come into widespread use, symptoms of its toxicity may not be familiar to all physicians who are encountering cases, and possibly cases have occurred in which the true etiology has been unrecognized.

Parathion is a deep brown liquid of low vapor pressure, some samples of which possess a characteristic odor. It is slightly soluble in water, but is completely miscible in many organic solvents including ethers, alcohols, and animal and vegetable oils. It is stable in a neutral solution but is rapidly hydrolyzed in the presence of alkalies, including soap. In actual application as an insecticide, the material may be used as a wettable powder or a dust.

Cases of poisoning have occurred in people engaged in the manufacture of the material, in those compounding solutions, in agricultural workers applying it, and even in people who have unwittingly come in contact with it. An example of the last is the case of a welder who cut into a pipe containing parathion and developed symptoms of poisoning ten minutes later.

Absorption—In experimental animals it has been demonstrated that parathion is readily absorbed through the skin and from the respiratory and digestive tracts. Almost all clinical cases of poisoning have occurred as a result of absorption through the skin or respiratory tract, and symptoms have appeared within a very brief period after exposure, indicating rapid uptake by the body. In some cases, local dermatitis has been observed at the site of contact. If the material should be splashed in the eye, there is an intense miosis, resulting in temporary blindness.

From the Bureau of Adult Health, State of California Department of Public Health.

Pharmacology—The principal mode of action of parathion is the inactivation of the enzyme cholinesterase. This enzyme, present in blood and nervous tissue, destroys acetylcholine, and in its absence the accumulation of acetylcholine results in excessive parasympathetic nervous system activity. This muscarine-like effect is the underlying cause of the multitude of symptoms which has been recorded by various writers throughout the country.

Signs and Symptoms—Observed cases have varied from those showing mild, transient symptoms to those with severe toxemia resulting in death. Early signs and symptoms include headache, nausea, vomiting, dizziness, cramps, and constriction of the pupils. More severe poisoning is manifested by a feeling of tightness of the chest, difficulty in breathing, fibrillary twitching of the voluntary muscles, convulsions, pulmonary edema, and coma. There may also be diarrhea which may be bloody. Death results from a combination of pulmonary edema and congestion and edema of the brain.

Destruction of cholinesterase, producing the parasympathetic stimulation, results in smooth muscle spasm, excessive bronchial secretion, and capillary dilatation. Evidence concerning chronic toxicity and cumulative action is incomplete. However, studies are now under way to determine the effect of chronic exposure to dosages below those producing acute effects. It may possibly be that with chronic exposure, an irreversible destruction of cholinesterase can be produced.

Diagnosis—Accurate diagnosis depends upon obtaining a history of exposure to parathion. A high index of suspicion should be maintained, especially in agricultural areas where the material is most commonly used. However, cases have also occurred in the cities, especially among workers engaged in manufacture or formulation of the insecticide. Any patient who may have come in contact with parathion, and who complains of headache, dizziness, nausea, or blurred vision, should be suspected of suffering from acute poisoning. A lowered blood cholinesterase is confirmatory evidence. Ten cc. of citrated blood is necessary for this test, and the Bureau of Adult Health will run samples provided by any physician in California. Instructions regarding the preparation and mailing of specimens will be sent on request.

Treatment — Atropine is a specific therapeutic agent against the parasympathetic nervous system stimulation. Therapeutic doses (1/75 to 1/100 of a grain) should be administered early and frequently as indicated. Magnesium sulfate counteracts the hyperactivity of the myoneural junction and 10

to 20 cc. of a 10 per cent solution given slowly intravenously should be used in conjunction with atropine. At the earliest sign of pulmonary edema, oxygen is indicated and may be life-saving when administered early. Positive pressure may also be of value (oxygen under pressure of 4 to 6 mm. of water) in the treatment of pulmonary edema.

Prevention—Poisoning by this compound can be prevented if proper attention is given to safe methods of handling it and if all persons concerned appreciate its extreme toxicity. All contact with the bare skin must be avoided and rubber covered cotton gloves must be worn when handling parathion. If any of the material gets on the skin it should be thoroughly washed off with copious amounts of soap and water. Workmen should be provided with freshly laundered coveralls and should wear fresh clothing each day, including socks and underwear. Inhalation should be avoided by use of a chemical cartridge respirator approved by the U. S. Bureau of Mines. Workers should bathe with soap and water after using the material, and contamination of food and tobacco should be avoided. Any exposed person developing symptoms should immediately be removed from the exposure and seen by a physician.

Bureau of Adult Health—Physicians are urged to report cases of poisoning from insecticides to the Bureau of Adult Health, 2002 Acton Street, Berkeley 2, California. The Bureau's personnel and facilities are available to physicians for assistance in the diagnosis and prevention of these cases.

REFERENCES

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